3.4.9 PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY

Radiation Environment. Major sources and levels of background radiation exposure to individuals in the vicinity of INEL are shown in Table 3.4.9–1. Annual background radiation doses to individuals are expected to remain constant over time. The total dose to the population changes as the population size changes. Background radiation doses are unrelated to INEL operations.

Table 3.4.9–1. Sources of Radiation Exposure to Individuals in the Vicinity, Unrelated to Idaho National Engineering Laboratory Operation

Sources	Effective Dose Equivalent (mrem/yr)
Natural Background Radiation[a]	
Cosmic radiation	39
External terrestrial radiation	59
Internal terrestrial	40
Radon in homes (inhaled)	200
Other Background Radiation[b]	
Diagnostic x rays and nuclear medicine	53
Weapons test fallout	<1
Air travel	1
Consumer and industrial products	10
Total	403

[a] IN DOE 1994c.
[b] NCRP 1987a.
Note: Value for radon is an average for the United States.

Releases of radionuclides to the environment from INEL operations provide another source of radiation exposure to individuals in the vicinity of INEL. Types and quantities of radionuclides released from INEL operations in 1993 are listed in *The Idaho National Engineering Laboratory Site Environmental Report for Calendar Year 1993* (DOE/ID-12082 [93]). The doses to the public resulting from these releases are presented in Table 3.4.9–2. These doses fall within radiological limits (DOE Order 5400.5) and are small in comparison to background radiation. The releases listed in the 1993 report were used in the development of the reference environment's (No Action) radiological releases and resulting impacts at INEL in the year 2005 (Section 4.2.3.9).

Based on a risk estimator of 500 cancer deaths per 1 million person-roentgen equivalent man (rem) to the public (Section M.2.1.2), the fatal cancer risk to the maximally exposed member of the public due to radiological releases from INEL operations in 1993 is estimated to be 1.5×10^{-8}. That is, the estimated probability of this person dying of cancer at some point in the future from radiation exposure associated with 1 year of INEL operations is about 2 chances in 100 million. (Note that it takes several to many years from the time of radiation exposure for a cancer to manifest itself.)

Based on the same risk estimator, 1.5×10^{-4} excess fatal cancers are projected in the population living within 80 km (50 mi) of INEL from normal operations in 1993. To place this number into perspective, it can be compared with the number of fatal cancers expected in this population from all causes. The 1990 mortality rate associated with cancer for the entire U.S. population was 0.2 percent per year (Almanac 1993a:839). Based on this national mortality rate, the number of fatal cancers expected during 1992 from all causes in the population

Table 3.4.9–2. Radiation Doses to the Public From Normal Idaho National Engineering Laboratory Operation in 1993 (Committed Effective Dose Equivalent)

Members of the General Public	Atmospheric Releases		Liquid Releases		Total	
	Standard[a]	Actual	Standard[a]	Actual	Standard[a]	Actual
Maximally exposed individual (mrem)	10	0.030	4	0	100	0.030
Population within 80 km[b] (person-rem)	None	0.30	None	0	100	0.30
Average individual within 80 km[c] (mrem)	None	0.0025	None	0	None	0.0025

[a] The standards for individuals are given in DOE Order 5400.5. As discussed in that order, the 10 mrem/yr limit from airborne emissions is required by the CAA, the 4 mrem/yr limit is required by the SDWA, and the total dose of 100 mrem/yr is the limit from all pathways combined. The 100 person-rem value for the population is given in proposed 10 CFR 834 (see 58 FR 16268). If the potential total dose exceeds this value, it is required that the contractor operating the facility notify DOE.

[b] In 1993, this population was approximately 121,500.

[c] Obtained by dividing the population dose by the number of people living within 80 km of the site.

Source: IN DOE 1994c.

living within 80 km (50 mi) of INEL was 243. This number of expected fatal cancers is much higher than the estimated 1.5×10^{-4} fatal cancers that could result from INEL operations in 1993.

Idaho National Engineering Laboratory workers receive the same doses as the general public from background radiation but also receive an additional dose from working in the facilities. Table 3.4.9–3 presents the average worker, maximally exposed workers, and total cumulative worker dose to INEL workers from operations in 1992. These doses fall within radiological regulatory limits (10 CFR 835). Based on a risk estimator of 400 fatal cancers per 1 million person-rem among workers (Section M.2.1.2), the number of fatal cancers to INEL workers from normal operations in 1992 is estimated to be 0.030.

Table 3.4.9–3. Radiation Doses to Workers From Normal Idaho National Engineering Laboratory Operation in 1992 (Committed Effective Dose Equivalent)

Occupational Personnel	Onsite Releases and Direct Radiation	
	Standard[a]	Actual
Average worker (mrem)	ALARA	14.2
Maximally exposed worker (mrem)	5,000	1,000
Total workers[b] (person-rem)	ALARA	75

[a] DOE's goal is to maintain radiological exposure as low as reasonably achievable.

[b] The number of badged workers in 1992 was approximately 5,270.

Source: 10 CFR 835; DOE 1993n:7.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in *The Idaho National Engineering Laboratory Site Environmental Report for Calendar Year 1993* (DOE/ID-12082[93]). The concentrations of radioactivity in various environmental media (including air, water, and soil) in the site region (onsite and offsite) are also presented in that document.

Chemical Environment. The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media with which people may come in contact (for example, surface water during swimming, or soil through direct contact or via the food pathway). The baseline data for assessing potential health impacts from the chemical environment are those presented in Section 3.4.3.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (for example, air emissions and NPDES permit requirements), contribute toward minimizing potential health impacts to the public. The effectiveness of these controls is verified through the use of monitoring information and inspection of mitigation measures. Health impacts to the public may occur during normal operations at INEL via inhalation of air containing hazardous chemicals released to the atmosphere by INEL operations. Risks to public health from other possible pathways, such as ingestion of contaminated drinking water or direct exposure, are low relative to the inhalation pathway. At INEL, the risk to public health from water ingestion and direct exposure pathways is low because the surface water resource (Big Lost River) is not used for drinking or as a receptor for wastewater discharges.

Baseline air emission concentrations for hazardous chemicals and their applicable standards are included in the data presented in Section 3.4.3. These concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are in compliance with applicable guidelines and regulations. Information about estimating health impacts from hazardous chemicals is presented in Section M.3.

Exposure pathways to INEL workers during normal operation may include inhaling the workplace atmosphere and direct contact with hazardous materials associated with work assignments. The potential for health impacts varies from facility to facility and from worker to worker, and available information is not sufficient to allow a meaningful estimation and summation of these impacts. However, workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. INEL workers are also protected by adherence to OSHA and EPA standards that limit workplace atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring that reflects the frequency and amounts of chemicals utilized in the operational processes ensures that these standards are not exceeded. Additionally, DOE requirements ensure that conditions in the workplace are as free as possible from recognized hazards that cause, or are likely to cause, illness or physical harm. Therefore, worker health conditions at INEL are expected to be substantially better than required by the standards.

Health Effects Studies. No occupational epidemiological studies have been conducted at INEL to date, but two epidemiological studies have been conducted on communities surrounding INEL to determine if there are any excess cancers in the general population. No excess cancer mortality was reported, although excess cancer incidence was observed. However, no association of the excess cancer incidence with INEL was established. For a more detailed description of the study findings reviewed, refer to Section M.4.4.

Accident History. A recent study, the *Idaho National Engineering Laboratory Historical Dose Evaluation* (DOE/ID-12119), was conducted by DOE to estimate the potential offsite radiation doses for the entire operating history of INEL. Releases resulted from a variety of tests and experiments as well as a few accidents at INEL. The study concluded that these releases contributed to the total radiation dose during test programs of the 1950s and early 1960s. The frequency and size of releases has declined since that time. Based on information reported in the study, there have been no serious unplanned or accidental releases of radioactivity or other hazardous substance at INEL facilities in the last 10 years of operation. [Text deleted.]

Emergency Preparedness. Each DOE site has established an emergency management program that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered.

The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Participating government agencies whose plans are interrelated with the INEL Emergency Plan for Action include the State of Idaho, Bingham County, Bonneville County, Butte County, Clark County, Jefferson County, the Bureau of Indian Affairs, and Fort Hall Indian Reservation. INEL contractors are responsible for responding to emergencies that occur at their facilities. When an emergency condition exists at a contractor facility, the Emergency Action Director is responsible for recognition, classification, notifications, and protective action recommendations. At INEL, emergency preparedness resources include fire protection from onsite and offsite locations and radiological and hazardous chemical material response. Emergency response facilities include an emergency control center at each facility, at the INEL warning communication center, and at the INEL site emergency operations center. There are also seven INEL medical facilities available to provide routine and emergency service.